

Anthrax Response

By Heather MacKenzie-Carey

This is the first in a series of articles, each dealing with a specific biological agent and the implications of its hazard for EMS workers.

Imagine

It is 10:30 on a Friday evening. Your service is dispatched to the local arena for a respiratory distress call. On arrival the crew is directed to the first aid room. A political rally has been going on and one of the campaign managers is experiencing shortness of breath and general malaise. He is a known asthmatic, although he reports this feels more like the flu with some chest discomfort. Over the next 48 hours you start to realize a pattern to an increasing call volume. You are transporting patients with general malaise, fever, chills, non-productive cough and chest discomfort. Many of these patients report they were at the rally on Friday evening. The hospital is becoming overwhelmed with similar complaints. Two days after your service transported him, the campaign manager has died of septic shock. Other patients are worsening.

On Monday morning the ambulance director is called to an emergency meeting at the hospital. Police officers, acting on a tip and with the assistance of the department of health, are investigating an act of bio-terrorism. They believe there was an anthrax attack at the arena the night of the rally. It is believed the virus was distributed by aerosol through the heating ducts. The military has been called in to help. The initial crew on scene is to report to the hospital for antibiotics. A press release will be distributed to the media.

History of Use

There have been numerous anthrax hoaxes throughout the U.S. and Canada. Many of these hoaxes were directed at abortion clinics, schools and government buildings. This agent has become somewhat sensationalized as the bio-terrorist weapon of choice and has been the fictitious agent in movies and novels. "Anthrax was

weaponized by the United States in the 1950s and 1960s before the old U.S. offensive program was terminated. Iraq has also admitted to weaponizing anthrax." (USAMRIDD, 1999:11)

While anthrax can be contracted via cutaneous, gastrointestinal and inhalation methods, inhalation anthrax is the most severe and would be the most likely approach to be used by terrorists. Anthrax can be grown relatively easily after being extracted from infected soil. The spores can then be dispersed in an aerosol form at two to six microns in size such that they will enter the lungs on inhalation. These spores could be released in massive quantities using crop dusting planes, dispersal through air ventilation systems or other aerosol dispersal methods. It has been estimated that just a couple of hundred pounds of anthrax spores released from a low flying plane under the right atmospheric conditions could kill up to 3 million people. (Osterholm, 2000:67)

Humans can also contract inhalation anthrax by breathing in anthrax spores from contaminated animal products. "Endemic inhalational anthrax, known as Woollsorters' disease, is a rare infection contracted by inhalation of spores. It occurs mainly among workers handling infected hides, wool and furs." (USAMRIDD, 1999: 11)

Agent Characteristics

Bacillus anthracis, the causative agent of anthrax, is a rod-shaped, gram-positive bacterium. Anthrax is a naturally occurring disease in herbivores, particularly cattle, sheep and horses, although non-domesticated animals as well can contract the disease. The bacterium is capable of forming spores, which can then replicate in the soil and release their toxin. It is usually this spore form that is

infectious. The spores can live in the soil for many years.

Humans can contract anthrax through cutaneous, inhalation or gastrointestinal methods. Cutaneous transmission occurs when humans become infected with anthrax by handling animal products from infected animals. This form occurs most frequently on the hands and forearms of people working with infected livestock.

The intestinal form of anthrax (which is very rare in humans), is contracted by eating undercooked meat from infected animals. In this form the spore enters the GI tract where it begins to release its toxin, causing localized GI symptoms. As the bacteria is carried in the bloodstream to the lymph nodes it may develop into a systemic reaction.

Inhalation of anthrax spores has the greatest mortality rate. If the spores are of the proper size (1 to 2 microns) they can arrive at the lungs without being filtered out by the body's defensive mechanisms. Once in the lungs, the anthrax spore would be carried by macrophages throughout the circulation system. Once in the lymph nodes (with a particular propensity to the lymph nodes of the mediastinum) the spores germinate, growing into a live bacterium, reproducing and releasing their toxin. The bacteria continue to reproduce while the toxin begins to affect the body systemically and dramatically.

Signs and Symptoms

The signs and symptoms of anthrax differ somewhat according to the type: cutaneous, gastrointestinal, or inhalation.

Cutaneous. Most anthrax infections occur when the bacterium enters a cut or abrasion on the skin when handling contaminated objects. Skin infection starts as a raised itchy bump

similar to an insect bite. Within one to two days, it develops into a vesicle and then a painless ulcer with a black necrotic centre. Lymph glands in the adjacent area may swell. Deaths are rare with appropriate antimicrobial therapy and range from 20 to 25 per cent. Occasionally this local infection may develop into a systemic infection that is often fatal.

Intestinal. The intestinal form of anthrax can be contracted through eating undercooked, contaminated meat. In this case the toxin causes acute inflammation of the intestinal tract. Initial signs include nausea, loss of appetite, vomiting and fever. These signs are then followed by abdominal pain, vomiting of blood and severe diarrhea. Intestinal anthrax has a mortality rate of 25 to 60 per cent or upwards to 100 per cent if untreated.

Inhalation. After an incubation period of one to six days (depending upon the dose and strain of anthrax), the initial symptoms are gradual and non-specific. Fever, malaise and fatigue may be the first signs and symptoms, similar to influenza. Sometimes there is a nonproductive

cough and mild chest discomfort. Within two to three days, if untreated, the syndrome progresses to severe respiratory distress, dyspnea, edema, diaphoresis, stridor and cyanosis. The patient typically dies within 24 to 36 hours after the onset of respiratory distress.

Patient Treatment

Scene Survey/History Taking

Part of every scene approach or assessment should include looking for signs of the presence of a biological agent. In the case of anthrax, this would only be likely to be evident in the case of a suspicious package or threat which authorities were informed of. In such suspected cases, emergency workers should not be approaching the area without self-contained breathing apparatus to avoid inhalation exposure to the spores. Workers should also be gloved and gowned to avoid cutaneous transmission.

It is a more likely scenario that EMS crews would be unaware of the

causative agent in the initial phase of an outbreak. For this reason (and others) universal precautions should always be employed.

In any case of gastrointestinal complaint a thorough history is pertinent. In the case of gastrointestinal anthrax, the history taking would be similar to any GI complaint and should include ruling out the possibility of food poisoning. It is crucial to determine what the person has eaten, if anyone else has eaten a similar product, when and where it was consumed.

In the case of inhalation anthrax, the patient is likely to present with respiratory or flu-like symptoms. Ask whether or not the patient has been in public areas, such as sporting events or political rallies, to identify potential exposure. Patients should also be questioned as to recent travel experiences or unusual activities.

BLS Treatment

BLS treatment for both the gastrointestinal and inhalation anthrax patient will be similar. Treatment should be focused on maintaining an airway and adequate respiration.



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ALS Treatment

ALS treatment for both the gastrointestinal and inhalation anthrax patient, in addition to standard BLS treatment may include more aggressive attempts to maintain an airway and adequate respiratory volumes with intubation techniques.

Intravenous therapy should also be instituted and fluid volumes may be required as the patient deteriorates into a shock condition.

Hospital/Long-Term Treatment

Early management with antibiotic treatment is the only hope for survival. Ciprofloxacin is commonly the antibiotic of choice. Penicillin is also effective in most strains but penicillin resistant strains have been detected, so until the strain is known ciprofloxacin is likely to be used. Other antibiotics used may include tetracyclines and erythromycin. Antibiotics are given intravenously in large repetitive doses

while the patient remains in isolation.

Respiratory support and supportive therapy for shock, including fluid volume replacement, may also be initiated should the patient deteriorate.

Protection

Precautions

Direct person-to-person spread of anthrax most likely does not occur. Therefore, if emergency personnel practise universal precautions when treating infected patients, transmission should not occur. Due to the lack of case histories to draw on however this cannot be absolutely guaranteed.

If Exposed

A vaccine for anthrax has been developed and is available in limited quantities. Data on its effectiveness is limited and although positive response has been found in humans exposed to cutaneous anthrax, its protectiveness against inhalation anthrax remains unknown. The vaccine is given in series at 0, 2 and 4 weeks and then 6,

12 and 18 months, followed by yearly boosters.

Prophylaxis ciprofloxacin is recommended for all those exposed to anthrax. Antibiotics should be continued for at least four weeks and until three doses of the vaccine have been received.

Test your response

Go back to the original scenario. In light of this scenario or a similar situation, consider the following:

- Would your service report the unusual call volume and characteristics? If so, to whom would this be reported?
- Does your service have a protocol in place to manage an outbreak of anthrax? If so, are you aware of the correct procedures?
- Does your service have clear guidelines for the roles and responsibilities of medical personnel during an anthrax event according to the community response protocol?
- Does your service have adequate personal protection to equip a crew



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for initial response to an anthrax outbreak?

- Does your extended medical community have adequate quantities of ciprofloxacin and anthrax vaccine available should an outbreak occur?
- Do you know the signs, symptoms and emergency management of patients exposed to anthrax? **E**



About The Author.

Heather MacKenzie-Carey is the Vice-President of TPG Inc., an Emergency Management Consulting firm. Heather has over 20 years experience in the Health Care Industry as an emergency practitioner, educator and consultant. She has worked in public, private, rural, urban, mountain park, multidisciplinary, flight and clinical settings. She has also worked as an educator for the Aberdeen Hospital, the Jasper School District and the Southern Alberta Institute of Technology (SAIT).

Heather has completed a Masters of Science degree in the Study of Risk, Crisis and Disaster Management from the University of Leicester (UK). Her thesis focused on bio-terrorism and biological emergencies in Canada. The research analyzed the training needs required for emergency response to bioterrorism and biological emergencies from both the perspective of experts within the biological sciences and Canadian First Responders (EMS, police and fire disciplines). During her research efforts Heather attended a variety of conferences and talked to many experts both

in Canada and the United States on the unique challenges health professionals will face in the event of such an emergency. Prior to her Masters work, Heather graduated from Dalhousie University with a Science Degree in Health Education. She has a diploma in Paramedicine from the Northern Alberta Institute of Technology (NAIT), a Certificate of Social Work from the University of Waterloo and specialized training in critical incident stress debriefing.

For more information on her research findings, or emergency management products and services offered through Turning Point Group, you can contact Heather at Geomac@home.com or phone (403) 285-4774. You are also invited to visit the company's website at www.turning-pointgroup.com

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